
BULLETIN
OF
ENTOMOLOGICAL RESEARCH.

VOL. XII.

1921.

A REVISION OF THE GENUS *LEPTOCONOPS*, SKUSE.

By HENRY F. CARTER,

School of Tropical Medicine, Liverpool.

INTRODUCTION.

The genus *Leptoconops* was erected in 1890 by the Australian dipterist Skuse for a minute black Chironomid fly which he captured at Woronora, near Sydney, New South Wales. This genus he placed in the last of the three sections into which he divided the family CHIRONOMIDAE, namely, the CERATOPOGONINA. The fly greatly resembled a small species of *Simulium* in general facies, and presented certain peculiar characters which rendered it strikingly distinct from other members of the section. Indeed, certain authors (Mik 1894, Johannsen 1905) have since drawn attention to the marked similarity in the wing venation of an American species (*L. torrens*, Twns.) and *Corynoneura*, a genus of the subfamily CHIRONOMINAE. Later (1907) Noé suggested the formation of an additional subfamily—LEPTOCONOPINAE—for the Australian and allied species (at that time classified in three genera), and Malloch (1915), although acknowledging that the genus *Tersesthes*, Twns. (a synonym of *Leptoconops*), was unknown to him, associated it with the CHIRONOMINAE rather than with the CERATOPOGONINAE. Apart from the wing venation, however, *Leptoconops* shows no affinities with *Corynoneura*, but rather agrees with the Ceratopogonine midges, particularly in regard to the structure of the thorax and mouth-parts. Several species of *Leptoconops* have now been described, but owing to differences in the interpretation of, or slight variations in, some of the generic characters given by Skuse, as well as to subsequent descriptive errors, they have, in greater part, been referred to the genera *Tersesthes*, Twns., and *Mycterotypus*, Noé. As was to be expected, however, the close agreement exhibited in the diagnoses of these genera and of *Leptoconops* has caused several authors to suggest their identity; but indefinite or partial conclusions* only were reached, since the genotype of *Leptoconops* (*L. stygius*, Sk.) was not re-examined.

Through the courtesy of several gentlemen (individual acknowledgments are made in the text of the systematic portion of this paper) I have been privileged

* Castellani and Chalmers (1913 and 1919) give *Tersesthes* and *Mycterotypus* as synonyms of *Leptoconops*, stating that in so doing they follow Kieffer. The latter author, however, did not definitely reject these names, and in his recent works still refers to them.

to examine the majority of the known species of this genus, including *L. stygius*, and have thus been able to decide certain questionable morphological characters which were largely responsible for the previous confusion. The new species described herein were received from the Imperial Bureau of Entomology (per Dr. G. A. K. Marshall), the British Museum (per Mr. F. W. Edwards), and the United States National Museum (per Prof. L. O. Howard and Dr. J. M. Aldrich); the types and co-types of these species have been returned to the collections from which they came, as subsequently indicated at the end of the respective descriptions.

SYNONYMY AND CLASSIFICATION.

Skuse's definition of *Leptoconops* is as follows:—"Antennae in the female 2 + 11-jointed; first joint of scapus large, disciform; second smaller, globose; flagellar joints globose, gradually diminishing in size, more ovate towards the apex, terminal joint elongate-ovate. Proboscis prominent. Palpi four-jointed; first and second joints small, third greatly incrassated, about three times the length of the first or second; fourth not as long as the last, slender, cylindrical. Wings naked. All longitudinal veins taking their origin at the base of the wing. Marginal cross-vein present. Middle cross-vein wanting. Fourth and fifth longitudinal veins only forked."

In 1893 Townsend founded the genus *Tersesthes*, but although acquainted with Skuse's work, would seem not to have appreciated the close resemblance between his genus and *Leptoconops*. Practically the only points of difference between the two genera that can be obtained from his description are that the palpi are composed of three segments and the wings covered with microscopic hairs; but in his figure of the wing the costa is extended to the apex, terminating near the upper branch of the fourth vein.

Noé (1905) erected the genus *Mycterotypus* for two Italian midges. He was, however, doubtful as to its distinctiveness from *Leptoconops* and *Tersesthes*, and was unable to decide whether the differences between these two genera and *Mycterotypus* were real or apparent. But in view of the facts that he could distinguish satisfactorily only three palpal segments, that the venation apparently differed in several particulars, and chiefly that he believed the "cerci" (lamellae) to be absent in *Leptoconops*, he finally resolved to place his species in a separate genus.

Johannsen (1905) concluded that *Leptoconops* and *Tersesthes* were very closely related, if not identical, and that they could only be distinguished by the segmentation of the palpi. Kieffer (1906), however, retained all three of these genera, but subsequently (1908) suggested that they were probably synonymous and that Townsend's figure of the wing showing the extension of the costa to the apex was inaccurate. Langeron (1913), after studying the venation of a Tunisian species and the figures of the wings of *Leptoconops* and *Tersesthes*, considered the former genus and *Mycterotypus* very nearly allied, but expressed surprise that Kieffer should think *Tersesthes* and the latter identical. Lutz (1913) was the first author who actually compared specimens of any of these genera; he examined both of Noé's species of *Mycterotypus* and Townsend's *Tersesthes torrens*, and definitely decided that they were congeneric. De Meijere (1915) briefly discussed the differences which existed, or were said to exist, between the three genera, and concluded by adopting Kieffer's suggestion of identity and listing all the species then known under *Leptoconops*. The latter author, however, does not appear to have reached a definite decision in this regard, for although placing *Tersesthes* and *Mycterotypus* under *Leptoconops*, he yet (1917 and 1918) retains the names to indicate groups of species; moreover, in spite of previous suggestions of inaccuracy, he (1917) still accepts Townsend's interpretation of the wing venation, but employs it for purposes of specific differentiation!

Comparisons of the genotype species of *Leptoconops* (*L. stygius*), *Tersesthes* (*T. torrens*) and *Mycterotypus* (*M. bezzii*) have shown definitely that all are congeneric, and therefore the last two generic names must sink under *Leptoconops*. The value and nature of the various characters upon which the separation of these genera was based will be discussed later in connection with the external morphology.

In a supplement to his 1918 paper Kieffer divided *Leptoconops* into three genera as follows:—

- “ 1. Antennes de la ♀ composées de 12 articles ; crochets tarsaux simple, égaux, petits ; type : *kerteszi*, Kieff. (Région palearctique).

Genre *Holoconops*, n.g.

Antennes de la ♀ composées de 13 articles

2.

- “ 2. Crochets tarsaux de la ♀ bifides, les 2 rameaux inégaux (Indes orientales).

Genre *Schizoconops*, n.g.

Crochets tarsaux de la ♀ simple, inégaux au tarse antérieur, égaux au tarse postérieur (Australie).

Genre *Leptoconops*, Skuse.”

This classification cannot be maintained for two reasons: first, the two types of differential characters used are not of the same value and are neither of them sufficient for purposes of generic separation, and, secondly, the description of the claws of *Leptoconops* (with type *L. stygius*) is erroneous. *Holoconops* may be retained with advantage as a subgenus by reason of the antennal structure of the females, *Leptoconops*, in the restricted sense, being reserved for those species with the full complement of segments. *Leptoconops* (*sens. str.*) can, if necessary, be further separated into two groups on the structure of the claws; but even if such groups be worthy of subgeneric rank, the name *Schizoconops* cannot be employed, since the genotype of *Mycterotypus* (*M. bezzii* was the first species described by Noé) possesses toothed claws, thus giving the latter name priority.

In 1915 de Meijere described a species (*L. albiventris*) from New Guinea which differed from all other *Leptoconops* in the structure of the ovipositor. The discovery of an African species possessing a similar ovipositor, and the fact that in both species this character is supported by others not present in *Leptoconops*, appear to justify the erection of a new genus; this is described on p. 24 under the name *Acanthoconops*.

DISTRIBUTION.

The members of the genus *Leptoconops* (*sens. lat.*) are widely distributed, but so far as is known are confined to countries lying approximately between the parallels of latitude 40° North and 35° South. Representatives occur in Italy, Sardinia, Asia Minor, Bengal, Siam, Northern, Central and South-West Africa, United States of America, Cuba, Brazil and Australia. The two species of *Acanthoconops* are found in New Guinea and Zanzibar.

BIOLOGY.

Nothing is known of the life-histories or early stages of these flies, and comparatively little concerning the habits of the adults. In fact, the only species which have been studied in any detail are *L. bezzii* and *L. irritans*, both of which were investigated by Noé (1905 and 1907) in the Roman Campagna; and to a less extent *L. kerteszi* (*Mycterotypus lauræ*), observations on which have been recorded by Weiss (1912) and Langeron (1913). Certain authors (Noé, Lutz, and, according to Weiss, Bezzi) have suggested, in view of the greatly developed ovipositor, that the eggs are not deposited superficially, and that the larvae are terrestrial, living among the roots of grasses, etc. Noé, indeed, excluded water as the larval habitat, since he failed to rear either of the Italian species from various aquatic larvae collected during his investigations, even although adults of both flies were present in enormous numbers at the time; and because both species appeared and subsequently increased greatly in numbers at a period

when water was relatively scarce. Weiss, on the other hand, states that at Tabeditt, South Tunis, *L. kerteszi* and *Simulium maculatum*, Mg. (*S. lineatum*, Fries) occur in common swarms, and show such close association as adults that he believes the immature stages of the two flies will be found near together. In this connection I am indebted to Dr. J. M. Aldrich, of the United States National Museum, for the following interesting observation, which indicates that the larvae of *L. torrens*, at least, are terrestrial in habit. He writes: "Several years ago, before my connection with the Museum, I identified a few specimens as *Tersesthes torrens*. The two females, which I retained in my private collection, have labels reading, 'Maxwell, N.M. Reared from pupae of *Tachina mella*, Webster. No. 11154. C.K. Wildermuth.' The significance of the rearing record is that the adults made their appearance in a breeding cage containing pupae of the fly; this proves not parasitism, but that the larvae are terrestrial, as is known to be the case in some of the CERATOPOGONINAE."

A perusal of the data subsequently given in the systematic portion of this paper in connection with the habitats of the different species provides some indication of the types of country in which these flies are known to occur, and of the avidity with which they bite. It will be seen that they have been found in what appear to be both relatively dry and well-watered districts, also in low-lying as well as mountainous regions. Noé states that *L. irritans* is especially prevalent in the coastal plains of the Roman Campagna. Langeron records *L. kerteszi* from marshy places in the desert in southern Tunis; Willcocks (1918) has observed the same insect in the Nile delta; while Weiss, Townsend (1893) and others have found species at altitudes varying from 1,600 ft. to 7,000 ft. So far as is known, they are diurnal insects, continuing their activities throughout the hottest parts of the day. Noé states that in Italy *L. bezzii* and *L. irritans* (locally known as 'serapiche') appear towards the end of May, reach their maximum abundance about the middle of June, and then gradually decrease in numbers and disappear early in September. The females of several species are known to bite man and his domestic animals, and to the former at least sometimes cause great annoyance and inconvenience. In some districts they have gained an evil reputation, and indeed at certain seasons would appear to be very serious pests, since at the period of maximum abundance the females of some species attack in dense swarms. According to Noé, *L. irritans* may occur in such swarms that no defence is possible, and he adds that labourers working on the railway from Rome to Pisa were sometimes forced to take shelter in order to escape these massed attacks. *L. kerteszi* is also known to adopt this habit (Weiss), and Sambon (1913) states that Chalmers in the Nile delta "obtained from the fellahin a very definite history of small black, blood-sucking flies appearing in swarms, and Dr. Gough told him that this fly scourge of the delta is undoubtedly *Leptoconops*;" Chalmers was unable to find *Simulium* in this region, but *L. kerteszi* is abundant in certain localities (Willcocks). Pratt (1907), writing on North American blood-sucking midges, says that Barber considers *Leptoconops* (*Tersesthes*) "much worse as a pest than any *Ceratopogon* (*sens. lat.*) he has ever encountered." The bites are painful and the subsequent local reactions irritating and persistent; *L. irritans*, in addition, also causes considerable discomfort by crawling about the body, among the hair, beneath the clothes, in the ears, etc. (Noé). Noé's observations, however, tend to indicate that in some respects the habits of different species are not identical; *L. bezzii* is said to prefer the neighbourhood of houses and outbuildings rather than the open plains, and to be particularly attracted by poultry, in the houses of which the females shelter overnight. Further, although the females apparently prefer blood for food, Noé has seen both sexes of this species on flowers, and remarks that the males are especially fond of *Euonymus*.

ASSOCIATION WITH DISEASE.

Grassi (1901) endeavoured to obtain the experimental infection of *L. irritans*, Noé, with malaria parasites. He fed twenty-eight "wild" females of this species upon

three patients, two of whom were infected with *Plasmodium falciparum* and one with *Plasmodium falciparum* and *Plasmodium vivax*. No infection of these midges occurred although females of *Anopheles maculipennis* fed at the same time and on the same patients became infected from two of the three cases. Grassi concluded that *Leptoconops* (*Centropygus*) was not able to transmit human malaria.

In 1913 Sambon extended the possible carriers of pellagra to include, besides the SIMULIIDAE, certain blood-sucking midges; he particularly referred to *Leptoconops* in this connection, basing his chief reason for so doing on Chalmers's observations (see above) made in pellagra districts in Lower Egypt.

Chatton and Blanc (1917) in a paper on *Toxoplasma* and toxoplasmosis of the gundi (*Ctenodactylus gundi*) discuss the natural ectoparasites of this animal; among these they make specific mention of two biting flies, namely *L. kerteszi*, Kieff. (*Mycterotypus laurae*, Weiss), and *Simulium maculatum*, Mg. (*lineatum*, Fries).

SYSTEMATIC ACCOUNT.

Genus **Leptoconops**, Skuse (*sens. lat.*).

Leptoconops, Skuse, Proc. Linn. Soc. N.S.W. (2) iv, p. 288 (1890).

Tersesthes, Twins., Psyche, vi, p. 369 (1893).

Centropygus, Grassi (*nomen nudum*), "Die Malaria: Studien eines Zoologen," Jena, p. 118 (1901).

Mycterotypus, Noé, Atti Accad. Lincei, Ser. 5, Rendiconti, xiv, p. 114 (1905); Arch. Zool. Napoli, iii, p. 101 (1907).

Mycteromyia, Lutz (*nec Phil.*), Mem. Inst. Osw. Cruz, iv, p. 24 (1912); *ibid.* v, p. 69 (1913).

Holoconops, Kieff., Ann. Mus. Nat. Hung., xvi, p. 135 (1918).

Schizoconops, Kieff., Ann. Mus. Nat. Hung., xvi, p. 135 (1918).

The external morphology of the adults of this genus has been discussed in detail by Townsend (1893), Noé (1905 and 1907), and Langeron (1913) in relation to the species described by them. Owing probably to lack of material, however, no general account based on the examination of a number of species has yet been given, and it is therefore thought advisable—especially in view of the discrepancies which have appeared—to include here a description of the more important structures.

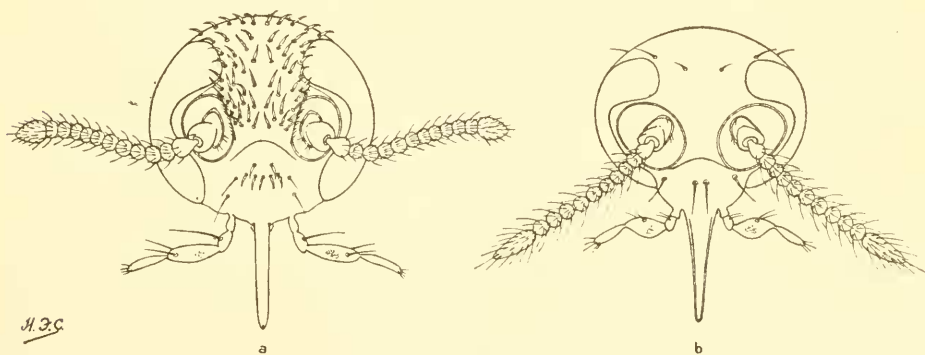


Fig. 1. Head of : (a) *Acanthoconops spinosifrons*, sp. n., ♀; (b) *Leptoconops kerteszi* var. *americanus*, n. (× 90 circa).

Head. Eyes bare, widely separate (the space between them varying from one-fifth to almost one-half the width of the head) in both sexes.* Vertex and occiput bearing a few short hairs or bristles; frons nude or with at most a single pair of short bristles between the eyes (fig. 1, b). Clypeus moderately pronounced, rounded, hairy.

Proboscis as long as, or rather less in length than, the height of the head. Mouth-parts in the female as follows: labium soft and hairy, broad, the labella relatively large; labrum strongly chitinised, broad at the base, gradually tapering towards a rounded apex, the extremity armed with three recurved teeth; hypopharynx less strongly chitinised than, but somewhat similar in shape to, the labrum, the apex devoid of teeth, pointed and scoop-like; mandibles and maxillae† well-developed, the former moderately chitinised, relatively broad and obliquely truncate or curved distally, bearing twelve to twenty-four small, closely apposed teeth, the maxillae narrower, slightly shorter and more pointed, armed with from twelve to thirty larger and more widely separated teeth. Mouth-parts in the male less strongly chitinised than those of the female; extremity of the labrum hairy, mandibles not visible (? absent) in the single specimen available, maxillae slender, thinly chitinised, pointed, without teeth.

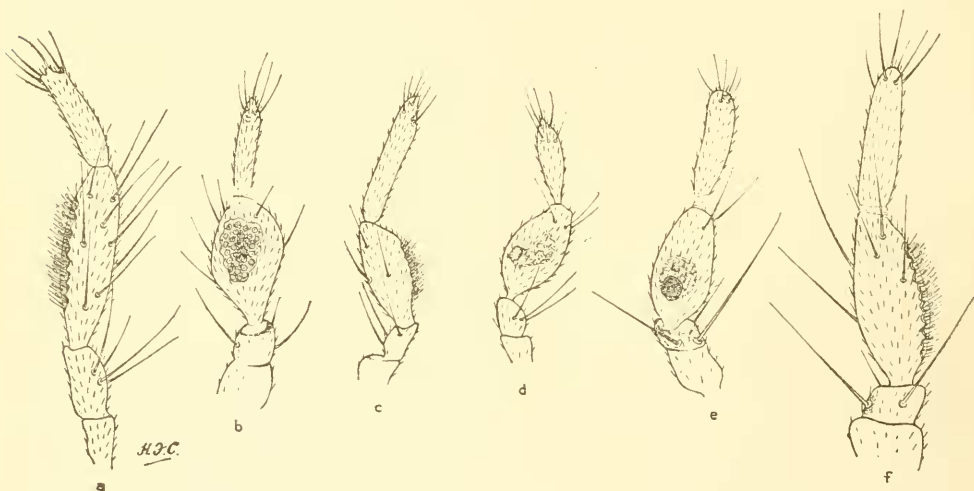


Fig. 2. Palpi of ♀ of: (a) *L. stygius*, Sk.; (b) *L. torrens*, Twms.; (c) *L. rhodesiensis*, sp. n.; (d) *L. kerteszi* var. *americanus*, n.; (e) *A. spinosifrons*, sp. n.; (f) *L. siamensis*, sp. n. (× 220 circa).

Palpi (fig. 2) composed of four segments. In the female the first and second segments are reduced in size and often indistinctly separated one from another, the third incresate, the last relatively large, representing the combined small fourth and fifth segments of other CERATOPOGONINAE; the sensory pit of the third segment is highly developed, the orifice often large, occupying the greater portion of the inner aspect, or occasionally small, sub-circular; terminal segment with an apical whorl of hairs. In the male the palpi are longer than in the female, and the third segment is not, or scarcely, swollen.

* In this account remarks concerning male characters are based upon the examination of a specimen provisionally referred to *L. torrens* (see p. 15) and Noé's description of *L. bezzii*. The male of *L. kerteszi* (*M. laurae*, Weiss) is not considered here, since, as shown on p. 22, its structure in certain respects is so peculiar that confirmation of Weiss's observations is desirable before any definite statements can be made.

† Langeron (1913) in his description and figure of the mouth-parts of the female of *L. kerteszi* var. *peneti* (*M. laurae* var. *peneti*) has, through incorrect interpretation, transposed the names of these structures.

The confusion which has arisen in regard to the segmentation of the palpi has been entirely due to the somewhat rudimentary nature of the first and second segments, and to the varying degrees of differentiation exhibited by them in certain species. The palpi have thus been described as possessing four, three, or even two segments when the basal ones were overlooked or ignored.

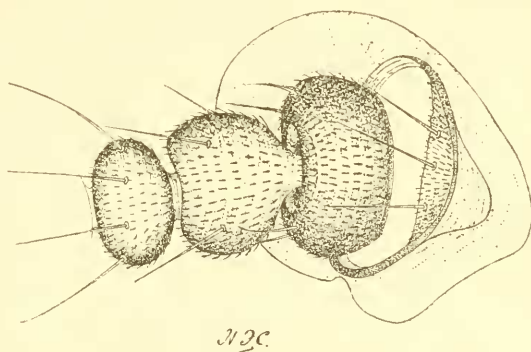


Fig. 3. Proximal portion of antenna of *Acanthoconops albiventris*, Meij., ♀, showing the reduced first segment; side view ($\times 510$ circa).

Antennae set in large subcircular, pale-coloured, thinly chitinised, depressed areas. In the female the antennae (fig. 5, *a-h*, and cf. fig. 1) are pilose, composed of thirteen (subgen. *Holoconops*) or fourteen (*Leptoconops*, *sens. str.*) segments; first segment (cf. fig. 3) (ignored by all previous authors except Lutz) cup-like, broad at the apex, where there is a rim of thickened chitin, narrowing rapidly to a conical base; second segment large and rounded, the inter-segmental membrane connecting it to the chitinised rim of the first, extensive; segments of the flagellum eleven or twelve in number, all but the last with a distinct whorl of hairs and two or more transparent spines; third segment (first of the flagellum) relatively large, pyriform; terminal segment elongate-oval, considerably longer than any of the others; intermediate segments (4 to 12 or 13) almost uniform in shape and size, often transversely oval or subspherical, rarely narrowly oval. In the male the antennae are longer and plumose, composed of fifteen segments; the two basal segments similar to those of the female but larger, the second very large; segments of the flagellum as shown in fig. 4, *h*, and described on pp. 16 and 17.

Thorax arched anteriorly but not projecting over the head, with short and somewhat sparsely arranged hairs on the dorsal surface. Situated laterally, near the anterior margin, and centrally, in front of the scutellum, are small depressions somewhat similar to those found in *Culicoides*; in each anterior depression, however, are two or three separate oval or rounded, seemingly membranous, areas (which frequently appear as small shining black spots in dry specimens), not a single slit-like area as in *Culicoides*. Scutellum with the posterior margin gently rounded, slightly produced laterally, bearing two or three pairs of strong, and sometimes a few pairs of smaller, bristles. Post-scutellum strongly arched, nude.

Wings white, iridescent, with the surface entirely covered with minute upright setae and with a fringe of longer hairs on the distal and posterior margins. The venation (fig. 7) is characteristic, but the veins, particularly the anterior ones, are ill-defined and difficult to distinguish. They can best be followed in dry specimens, but careful manipulation is necessary, as the detection of certain details depends largely on the angle of view and the illumination; in mounted specimens (unless stained) the venation cannot be observed. The costa is short and, in the female, usually terminates

well before the middle of the wing. The sub-costa is chitinated and more clearly defined than any other vein; it is closely apposed to the first longitudinal vein, and owing to the folding of the wing surface in this region, frequently obscures, or partly obscures, the base of the latter. The first and third longitudinal veins (the second is absent) are separate basally, but fuse distally, forming with the extremity of the costa a large, slightly raised, yellowish or pale brown area. These two veins are approximated throughout the greater portion of their course, but diverge slightly before fusing with one another and the costa; this approximation is usually greatest immediately before the divergence mentioned above, and in several species is so close that amalgamation has taken place, with the results that an apparent cross-vein has been formed and a small cell isolated (*cf.* fig. 8, *a-l*). The anterior or radio-medial cross-vein is absent. The general course of the fourth, fifth and sixth veins shows little variation; the upper branch of the fourth vein joins the apex of the wing below the middle, the lower branch is often very indistinct, with an apparently considerable portion of its base, and sometimes its apex, obsolete. At least three vein-like folds (indicated in fig. 7 by dotted lines) are present, and of these the most anterior—which is evidently homologous with the fold just above the upper branch of the fourth vein in other CERATOPOGONINAE—is relatively strong and conspicuous; it is, indeed, as strongly marked as any of the veins except the sub-costa, and by most authors has been interpreted as the third longitudinal vein.

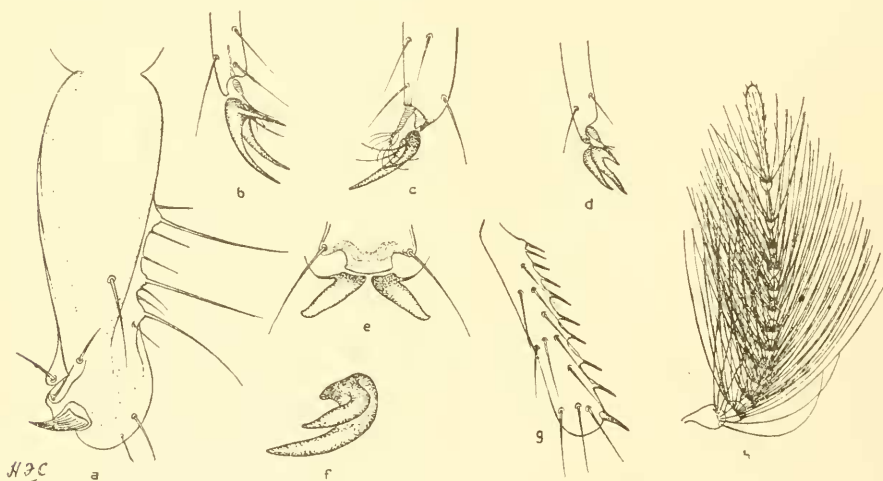


Fig. 4. *L. (?) torrens*, Twms., ♂: *a*, clasper; *b*, claws of front leg; *h*, antenna (flagellum).
L. kerteszi var. *americanus*, n., : *c*, claws of hind leg (near claw foreshortened).
L. bezzii, Noé, ♀: *d*, claws of middle leg.
L. stygius, Sk., ♀: *e*, claws of front leg (ventral view empodium omitted).
L. siamensis, sp. n., ♀: *f*, one claw of front leg.
L. brasiliensis, Lutz, ♀: *g*, first tarsal segment of front leg.
(*a* × 770; *b, c, f* × 490; *d* × 220; *e* × 450; *g* × 260; *h* × 90.)

As will be gathered from a perusal of the subsequent specific descriptions and from the illustrations referred to above, this account of the wing venation is based upon the study of the wings of females of several species. Among these are included most of the forms previously referred to *Tersesthes* and *Mycterotypus*, and it therefore follows that the venation in these insects is in no way peculiar, and that venational characters which have been advanced for the retention or differentiation of these genera are either of little value or are the results of incorrect observations.

Legs moderately long, the hind pair longest, clothed with short hairs. Femora unarmed. Tibiae each armed distally with a short, stout, ventral spur, those of the fore and hind legs in addition with one or two oblique rows of bristles. First tarsal segment of the fore and middle legs about twice the length of the second, of the hind legs about one and one-half times the length of the second; second to fourth tarsal segments cylindrical, decreasing in length progressively, the fifth segment distinctly longer (in *L. lacteipennis* Kieffer states that it is shorter) than the fourth. Differentiation of the apical bristles of the first and second tarsal

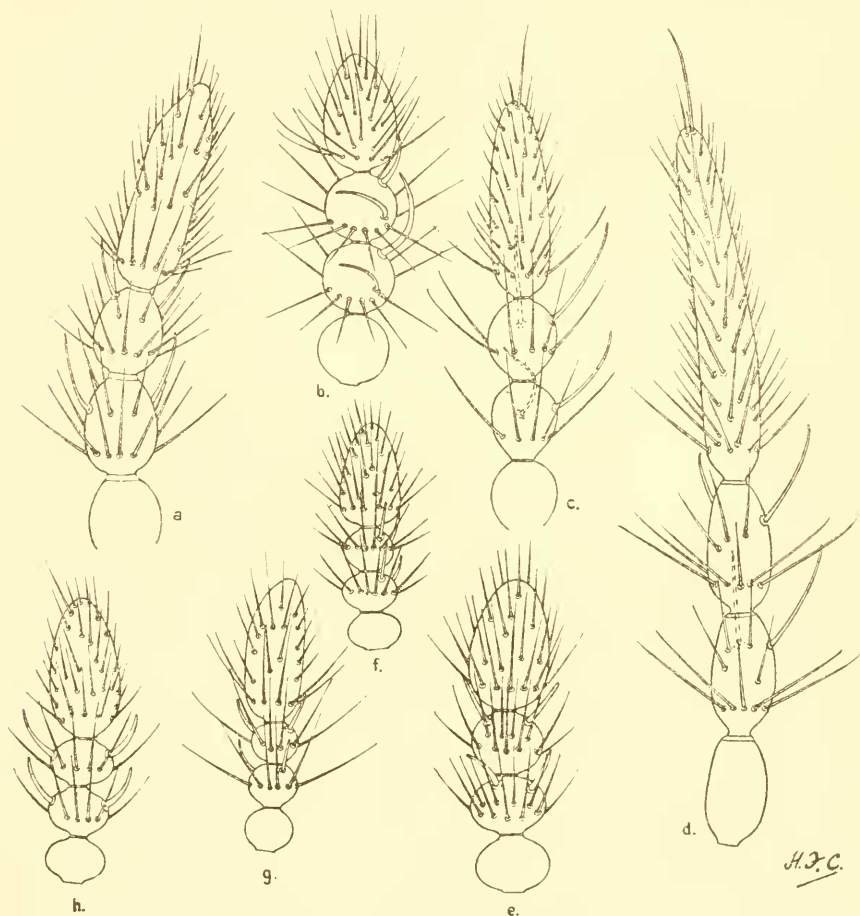


Fig. 5. Terminal segments of antennae of females of: (a) *L. siamensis*, sp. n.; (b) *L. stygius*, Sk.; (c) *L. grandis*, sp. n.; (d) *L. longicornis*, sp. n.; (e) *L. rhodesiensis*, sp. n.; (f) *Acanthoconops spinosifrons*, sp. n.; (g) *L. kerteszi* var. *americanus*, n.; (h) *L. torrens*, Twins. ($\times 260$ circa).

segments into spines has taken place in most species, and of some of the ventral bristles of the first segment (fig. 4, g) in a few species. In the latter case considerable prominence has been given to this character by some writers in their specific descriptions, and the exact number and arrangement of such spines has been recorded; but variation in details is frequent, and may occur not only in

different individuals of the same species, but on different legs of the same individual (*cf.* footnote p. 20). Claws equal, small, less than one-half the length of the fifth segment; in the female similar on all the legs, either simple, each with a bristle arising from the base (fig. 4, *c* and *e*) or dentate, with a strong basal tooth (fig. 4, *d* and *f*); in the male (fig. 4, *b*) dissimilar on the fore and middle legs, one simple, the other with a long basal tooth (in *L. bezzii* both are said to be dentate), on the hind legs similar, simple. Empodium in the form of a minute branched bristle.

Abdomen of the female composed of nine segments—the ninth greatly reduced in size—clothed with short hairs, and bearing distally two exceedingly long, narrowly conical lamellae (fig. 6). Genital orifice, anteriorly, with a semi-circular chitinous border from which arise numerous small and a few long hairs, the latter directed inwards and backwards over the aperture. Spermathecae usually two in number (occasionally, e.g., *L. kerteszi*, a small third spermatheca is present), subspherical or oval and but slightly produced posteriorly before the junction with the duct. Abdomen of the male more slender than that of the female, the hypopygium conspicuous.

Subgenus **Leptoconops** (Skuse), Carter.

As here restricted, this subgenus includes only those species in which the antennae of the female are composed of fourteen segments; in this sex the species fall into two groups according to the claws being simple or dentate.

Leptoconops stygius, Skuse.

Leptoconops stygius, Skuse, Proc. Linn. Soc. New South Wales, (2) iv, p. 288 (1890).

Leptoconops skusii, Noé (error in explanation of Plate v), Arch. Zool. Napoli, iii (1907).

Skuse's description of this species, the type of the genus *Leptoconops*, is as follows:—

“♀.—Length of antennae, 0·42 mm.; expanse of wings, 1·27 mm.; size of body, 1·66 mm. Entirely black. Joints of antennae with dense light-greyish verticils. Head and thorax levigate, with minute black hairs. Abdomen about twice the length of the thorax, opaque, with some minute black hairs; lamellae very long, slender. Legs slender. Hind metatarsus one-third longer than the second tarsal joint. In the fore legs, the tibiae rather more than twice the length of the metatarsus. Wings hyaline, rather weakly iridescent; costal and first two longitudinal veins greyish-brownish, the rest pale and indistinct. Auxiliary vein not distinguishable, apparently wanting; first and second [*i.e.*, third] longitudinal veins reaching costa before the middle of the anterior border, confluent at the tips, tip of second longitudinal vein almost opposite but immediately beyond the tip of the posterior branch of the fifth longitudinal vein; marginal cross-vein indistinct; marginal cell small; third longitudinal vein [*i.e.*, the strong fold situated in the upper portion of the wing] arcuated, not quite reaching the margin, terminating a little above the apex of the wing; fourth longitudinal vein bellied downwards at the middle, reaching the margin a little below the apex of the wing, the posterior branch detached; fork of fifth longitudinal vein wide, the anterior branch twice the length of the posterior.

“*Habitat.* Woronora (Skuse). October.”

Through the kindness of Professor S. J. Johnston, of Sydney University, I have been able to examine one of the three specimens of *L. stygius* contained in the Macleay Museum, Sydney, and am thus in a position to supplement the above description with some important morphological details.

♀.—Length of body (specimen mounted in balsam), 2.5 mm. ; length of wing, 1.3 mm. ; length of antenna, 0.48 mm. ; width of head, 0.40 mm.

Head. Eyes relatively narrowly separated, the space between them almost one-fifth the greatest width of the head ; clypeus with two pairs of short hairs. Third palpal segment (fig. 2, *a*) relatively not very strongly swollen, elongate, the orifice of the sensory pore extending over the greater portion of the inner side ; fourth segment subcylindrical, about two-thirds the length of the third. *Antennae* (fig. 5, *b*) : fourth to thirteenth segments spherical, with the hairs arranged in oblique whorls, and the spines unequal in size and asymmetrically arranged ; terminal segment short, approximately one and two-thirds as long as broad. *Wings* with anterior veins as shown in fig. 8, *a*.* *Legs* : first and second tarsal segments without differentiated spines, except distally. Claws (fig. 4, *c*) simple and equal, each with a bristle arising from the base. Lamellae bluntly rounded distally, 0.22 the length of the wing. Spermathecae two, heavily chitinated, subspherical (diameter 30μ) ; the commencement of the duct chitinated for a short distance.

***Leptoconops longicornis*, sp. nov.**

♀.—Length of body (two specimens), 3.5 mm. ; length of wing, 2.2 mm. ; length of antennae, 0.84 mm. ; width of head, 0.44 mm.

Head black,† the antennal depressions pale brown, sparsely clothed with short hairs on the occiput and vertex ; clypeus blackish, with three pairs of dark brown hairs ; eyes not very widely separated, the space between them being approximately one-fifth the width of the head ; frons with a pair of short hairs situated, one on each side, near the lower margins of the eyes. Proboscis blackish brown. Palpi blackish brown, with dark hairs ; third segment elongate, relatively slightly swollen, the orifice of the sensory pit large, occupying the distal two-thirds of the inner side ; fourth segment subcylindrical, stout and short, not more than two-thirds the length of the third. *Antennae* (fig. 5, *d*) long, dark brown, bearing short brown hairs, and long, slightly curved, clear, pointed spines ; fourth to thirteenth segments subspherical to narrowly oval, from 1.0 to 2.1 as long as broad ; fourteenth segment approximately six and one-half times as long as broad, equal in length to the three preceding segments together. *Thorax* shining black (from indications still existing in the dried specimens the scutum was probably dark grey pollinose originally), sparsely clothed with short dark hairs ; scutellum normally with three pairs of stout black bristles ; pleurae and pectus shining black. *Wings* white, iridescent, the fusion of the extremities of the anterior veins forming an elongate brown spot near the middle of the upper margin ; anterior veins as shown (fig. 8, *b*), the distal interspace clearly defined, fifth vein bifurcating appreciably before the extremity of the costa. Halteres greyish buff, the stems somewhat infuscated. *Legs* uniformly dark brown, clothed with dark hairs ; tarsi without distinct spines (except perhaps a distal pair on the metatarsi), but with some of the ventral bristles on the first and second segments stout and spine-like. Claws, equal and simple, similar to those of *L. stygius*. *Abdomen* dark brown, with short dark hairs. Lamellae (fig. 6) paler brown, 0.18 the length of the wing. Spermathecae two, heavily chitinated, subspherical (diameter 50μ) ; the origin of the duct only chitinated.

* I have been totally unable to distinguish the small " vein " (termed by Skuse the " marginal cross-vein ") connecting the distal portions of the first and third veins. The first vein, however, bends sharply upwards just before its termination and at the angle is distinctly swollen, causing the lower edge of the vein to approach more closely that portion of the third vein immediately below it ; at first sight, therefore, the first and third veins appear to be connected at this point and to enclose a minute distal interspace.

† The colours given in the descriptions of this and the following species are as observed in specimens which had been dried after preservation in formalin.

Habitat. Interior of Western Australia: (*J. W. Dakin*), 1915. Five females (two cotypes) in the British Museum Collection.

Professor Dakin states that these midges do not trouble one before 10 a.m., and that they disappear at dusk; in between these hours they bite furiously, and the bite irritates for days afterwards.

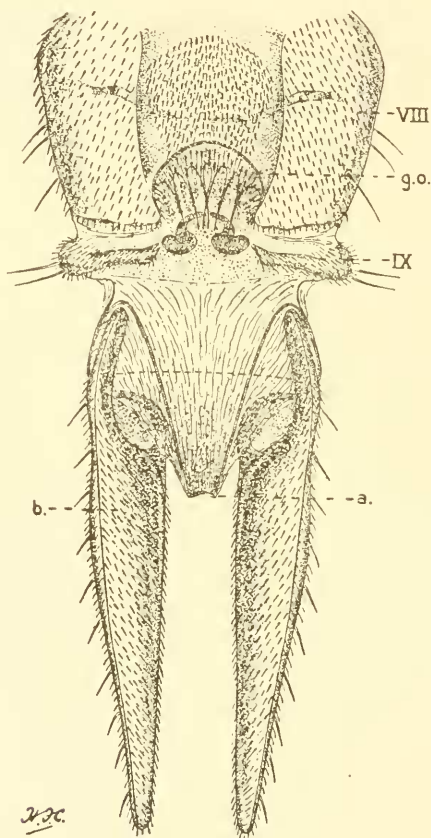


Fig. 6. *Leptoconops longicornis*, sp. n., ventral view of extremity of abdomen of ♀; g.o., genital orifice; viii, sternite of eighth segment; ix, sternite of ninth segment; a, anus; b, lamellae; ($\times 180$ circa).

***Leptoconops grandis*, sp. nov.**

♀.—Length of body (one specimen), 3.5 mm.; length of wing, 2.0 mm.; length of antennae, 0.62 mm.; width of head, 0.44 mm.

Two females of this species, captured at the same place and time and bearing the same data attached to the label as the specimens of *L. longicornis*, were included in the material collected by Professor Dakin. Indeed the two forms were contained in the same tube and, except in antennal structure and certain details of minor importance, resemble one another so closely that, in the absence of males, it is difficult

to know exactly what value to place upon the differences observed. The antennal structure, however, differs so strikingly that I believe specific separation to be warranted; especially since no tendency to intermediate characters occurred in the small series of specimens obtained, and no obvious variation has been seen in the antennal structure of species of which numerous examples have been examined.

The antennae (fig. 5, c) are very distinctly shorter than in the preceding species, and the intermediate segments of the flagellum (4 to 13) are subspherical, being from 1.0 to 1.1 times as long as broad; the terminal segment is almost three and one-half times as long as broad, and is equal in length to the preceding two and one-half segments together. Minor differences appear to exist in regard to the venation (*cf.* fig. 8, b and c), and the dark grey pollinosity of the head and thorax; but, as indicated above, the appearance of the latter may be that normally found in *L. longicornis*.

The two females (cotypes) of this species are in the British Museum Collection.

The three Australian representatives of *Leptoconops* (*L. stygius*, *L. longicornis* and *L. grandis*) at present known are closely related, and as a group are characterised by the relatively narrow space separating the eyes, the structure of the palpi (*i.e.* in regard to the relative lengths of the third and fourth segments), and the absence of spines on the first and second tarsal segments.

***Leptoconops braziliensis*, Lutz.**

Tersesthes braziliensis, Lutz, Mem. Inst. Oswaldo Cruz, v, p. 66 (1913).

The description of this species given below is drawn up from that published by Dr. Lutz, and from microscopical preparations kindly lent me by him.

♀.—Length of body (two specimens), 1.5 mm.; length of wing, 0.8 mm.; length of antennae, 0.32 mm.; width of head, 0.23 mm.

Head dark brown; clypeus with a few short, dark hairs. Proboscis and palpi dark brown; the latter with the third segment moderately swollen and the orifice of the sensory pit large and oval, the fourth segment subcylindrical, almost equal in length to the third. *Antennae* dark brown, with dark hairs and short, slightly curved, clear spines; fourth to thirteenth segments transversely oval, from 0.6 to 0.8 as long as broad; thirteenth segment somewhat pointed distally, two and one-half times as long as broad, almost equal in length to the preceding four segments together. *Thorax* dark brown, clothed with short hairs; pleurae and pectus rather paler in colour than the dorsum. *Wings* white, the basal part of the costa waxen yellow-brown, the costa extending to the middle of the anterior border; anterior veins arranged as in fig. 8, g, the fifth vein bifurcating before the extremities of the third vein and costa. Halteres with pale knobs and brown stems. *Legs* brown, the tarsi paler; metatarsi of the four anterior legs (fig. 4, g) with several pairs of distinct spines, of the hind legs with short stout bristles, but with spines only at the apex (distal pair); second tarsal segments of all the legs with a pair of spines at the apex. Claws simple and equal, each with a bristle arising from the base. *Abdomen* dark brown dorsally, the fore and hind margins of the tergites narrowly paler; venter pale brown. Lamellae waxen brown, darker at the extreme base, relatively long, 0.33 the length of the wing. Spermathecae two, strongly chitinated, oval ($33\mu \times 24\mu$).

Habitat. Brazil: lower reaches of the Rio Tocantin.

According to Lutz this species sucks blood and often attacks man. It may be readily distinguished from other species of *Leptoconops* (*sens. str.*) which possess simple claws by the unusually long lamellae.

Leptoconops irritans, Noé.

Mycterotypus irritans, Noé, Atti R. Accad. Lincei, Ser. 5, Rendiconti xiv, p. 118 (1905); Arch. Zool. Napoli, iii p. 138 (1907).

Centrotypus irritans, Grassi (*nomen nudum*), "Die Malaria: Studien eines Zoologen," Jena, pp. 118-122 (1901).

This species occurs with *L. bezzii* (see page 17) in the Roman Campagna, where, according to Noé, it is very abundant from June to the end of July, and may be found in diminished numbers late in August. The female only is known, and in this sex the species may readily be distinguished from *L. bezzii* by its general facies. Noé confined himself to a comparative description, and gave the following principal differences between it and the latter species.

Size smaller (length, 1.5 mm.; spread of wings, 2 mm.); proboscis and palpi relatively longer, the former more slender, cylindrical; antennal hairs sparser and more spinose; claws simple, the large basal tooth replaced by a robust bristle; abdomen white, becoming isabella-coloured dorsally.

To these I am able to add further details of specific importance, obtained from Sardinian specimens sent me by Professor M. Bezzi.

♀.—Length of body (one specimen), 1.7 mm.; length of wing, 1.1 mm.; length of antenna, 0.53 mm.; width of head, 0.30 mm.

Eyes separated by about one-third the width of the head. Antennal segments 4 to 12 transversely oval to spherical, the length from 0.7 to 1.0 the width; terminal segment about two and one-third times as long as wide, slightly longer than the two preceding segments together. Scutellum with two pairs of bristles. Metatarsi of the fore and middle legs with a few small but distinct spines ventrally, of the hind legs with short, stout bristles, intermixed with which may be one or two spines. Lamellae approximately one-fifth the length of the wing. Spermathecae two (in the single preparation examined a third, very small, oval spermatheca was also present), highly chitinised, oval, relatively large ($64\mu \times 36\mu$), the commencement of the duct chitinised for a very short distance.

Noé's figure of the female palpi shows an exceptionally long, slender terminal segment. This segment, if the drawing is accurate, is considerably longer than the third (the ratio being 1.2: 1)—a condition which does not occur in any other species. Unfortunately in the specimens at my disposal the palpi are absent or so damaged or arranged that details cannot be observed.

Habitat. Italy: Roman Campagna; Sardinia, Cagliari. According to Weiss, Bezzi believes that both *L. irritans* and *L. bezzii* are widely distributed in Northern Italy.

Leptoconops rhodesiensis, sp. nov.

♀.—Length of body, 2.5 mm.; length of wing, 1.2 mm.; length of antenna, 0.4 mm.; width of head, 0.33 mm.

Head shining black, clothed with short, blackish hairs on the vertex and occiput; clypeus dark brown, with several (about twelve) dark-coloured hairs; eyes rather widely separated, the space between them about one-third the greatest width of the head. Proboscis dark brown or black. Palpi (fig. 2, c) dark brown, with dark hairs; third and fourth segments elongate, the third much swollen, with the orifice of the sensory pit moderately large, subcircular, and almost centrally situated, the fourth slightly longer than the third. *Antennae* (fig. 5, e) dark brown, with short paler brown hairs and relatively stout blunt spines; segments 4 to 13 transversely oval to sub-spherical, the length being from 0.6 to 0.9 times the breadth; fourteenth segment ovate, as long as the two preceding segments together. *Thorax* shining black, clothed

with short black hairs ; scutellum and postscutellum similarly coloured, the scutellum with three pairs of black bristles ; pleurae and pectus shining black. *Wings* (fig. 7) whitish, strongly iridescent ; first and third veins joining the anterior margin near the proximal third, point of bifurcation of the fifth vein situated considerably beyond the extremities of the costa and third veins. Halteres whitish, opalescent. *Legs* : femora and tibiae dark brown, with pale hairs, metatarsi and second tarsal segments without conspicuous spines, except distally, where differentiation (into spines or stout

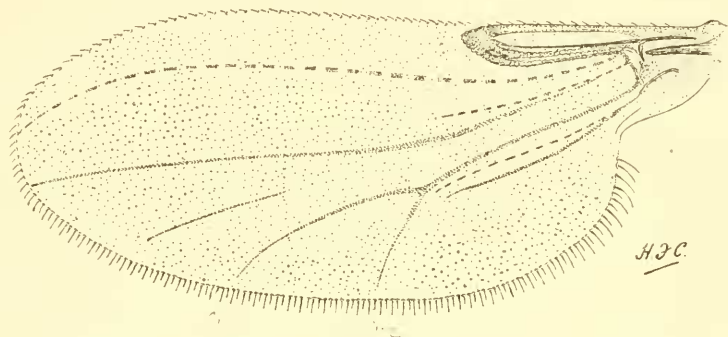


Fig. 7. Wing of *Leptoconops rhodesiensis*, sp. n., ♀ ($\times 75$ circa).

spine-like bristles) of the apical pair of bristles often takes place. Claws equal, simple, each with a short bristle arising from the base. *Abdomen* : dorsum sepia-coloured (shining when held in certain positions), the apical margins of the tergites narrowly paler brown ; venter sepia-coloured medially, paler brown laterally ; both surfaces with short dark hairs. Lamellae dusky white or light grey, 0.2 times as long as the wing. Spermathecae strongly chitinised, apparently elongate-oval (collapsed in the single specimen available) ; the commencement of the duct chitinised for a very short distance.

Habitat. North-Western Rhodesia : Kafue Flats, 3,000 ft., 19.x.1913 (R. C. Wood), "Biting myself" ; 1 ♀ (type) in the collection of the Imperial Bureau of Entomology.

This species should be recognised without difficulty by the wing venation, the short extent of the anterior veins being a conspicuous character. From *L. (Holoconops) interruptus*, End., the only other species yet described from South Africa, it may, of course, be immediately separated by the structure of the antennae. The coloration of the abdomen given above must be regarded with reserve, since the specimen was caught when biting and probably contained undigested blood.

***Leptoconops torrens*, Twins.**

Tersesthes torrens, Twins., Psyche, vi, pp. 369-371 (1893).

This species, the type of the genus *Tersesthes*, Twins., belongs to the group of species in which the claws are simple. I am indebted to Professor L. O. Howard and Dr. J. M. Aldrich for the opportunity of examining female specimens from the Organ Mountains, New Mexico, and a microscopical preparation of a male from Las Vegas Hot Springs, New Mexico. The females were collected by Townsend on horses, and agree in all essentials with his description ; the males, however, cannot at present be more than provisionally associated with this species, but in view of Weiss's description of the male antennae of *L. (Holoconops) kerteszi* (*M. laurae*, Weiss), appear

to be referable to it rather than to the other American species—*L. kerteszi* var. *americanus*, nov.

♀.—Length of body (one specimen), 2.2 mm. ; * length of wing, 1.1 mm. ; length of antennae, 0.33 mm. ; width of head, 0.30 mm.

Head shining dark brown or blackish, the antennal depressions cinnamon-coloured, clothed with short dark hairs on the vertex and occiput ; clypeus dark brown, with twelve hairs—five on each side and two central ; eyes separated by a space equal to about one-third the width of the head. Proboscis black. Palpi (fig. 2, *b*) blackish brown ; third segment greatly swollen, with the orifice of the sensory pit large, more or less ovate, occupying the distal two-thirds of the inner side ; fourth segment sub-cylindrical, distinctly (one-fifth) shorter than the third. Antennae (fig. 5, *h*) short, dark brown, with greyish hairs and moderately long, curved spines ; fourth to thirteenth segments transversely oval, from 0.6 to 0.8 as long as broad ; fourteenth segment slightly more than twice as long as wide, equal in length to the three preceding segments together. *Thorax* shining black or blackish brown, sparsely clothed with short dark hairs ; scutellum with three pairs of black bristles, the central pair large. *Wings* whitish, the anterior veins terminating in a brown stigma at some distance before the middle, arranged as in fig. 8, *c* ; fifth vein bifurcating below the ends of the costal and third veins. Halteres white, the stems infuscated. *Legs* blackish brown, the tarsi paler brown ; metatarsi and second tarsal segments without spines except at the extremities. Claws simple, equal, each with a basal bristle. *Abdomen* brown, distinctly paler than the head and thorax, with short dark hairs. Lamellae brown, 0.18 the length of the wing. Spermathecae two, highly chitinised, sub-spherical (diameter 36μ) ; the commencement of the duct scarcely chitinised.

♂.—Length of body (one specimen), 1.9 mm. ; length of wing, 1.1 mm. ; length of antennae, 0.71 mm. ; width of head, 0.30 mm.

General coloration apparently (so far as can be judged from a balsam preparation) dark brown or blackish, the tarsi paler. *Head* : frons bare, occiput and vertex with scanty hairs ; clypeus with two pairs of short hairs, eyes widely separated, the space between them being two-fifths the width of the head. Palpi : third and fourth segments sub-equal, the third slender, the sensory organ situated in the distal half. *Antennae* (fig. 4, *h*), very similar to those of the male *L. bezzii* (*q.v.*), but with the basal segments of the flagellum less compressed, the fourteenth segment relatively shorter (about three and one-half times as long as wide, and slightly more than one-third the length of the last segment), and the fifteenth segment more strongly swollen distally ; fourth to thirteenth segments varying from 0.6 to twice the width, fifteenth segment nearly eight times as long as the greatest width (*i.e.*, near the distal extremity), fourteenth and fifteenth segments, taken together, about equal in length to the preceding seven segments united. *Thorax* : scutellum with two pairs of bristles.† *Legs* slender, especially the middle and hind pairs ; metatarsi of the four anterior legs with a few small spines (usually one pair at the base and apex and one, unpaired, near the middle), hind metatarsi and second tarsal segments with a pair of spines or spine-like bristles at the apex. Claws of the fore and middle legs equal, one with a long basal tooth (fig. 4, *b*), the other with a bristle ; of the hind legs equal and simple. *Hypopygium* : Unfortunately the single preparation available is not in a sufficiently good condition to allow a satisfactory interpretation of the detailed structure of the intermediate appendages, but the claspers (fig. 4, *a*) are of peculiar form and will probably provide specific characters.

* Townsend gives the length of the body (including the lamellae) as 1.6 mm. to 2.2 mm. according as the abdomen is empty or distended with blood.

† The characters afforded by the wings cannot be determined in microscopical preparations with any degree of accuracy, unless the specimen is stained. In addition, the wings in the specimen described were considerably twisted.

Habitat. U.S.A.—New Mexico : Continental Divide, 7,000 ft., 21st June, (C. H. T. Townsend—type series), Organ Mountains, 5,700 ft., 29th Aug. (C. H. T. Townsend—♀♀ described above) ; Las Vegas Hot Springs (H. S. Barber—♂ described above).

Dr. Aldrich informs me that, besides the localities mentioned above, the *Leptoconops* material in the United States National Museum includes females from Arizona, Colorado, Florida, Texas, Utah and Cuba, and males from Arizona. The specimens from Utah are *L. kerteszi* var. *americanus*, nov., but the others have not yet been definitely determined, and are provisionally referred to *L. torrens*.

Pratt (1907) mentions several of the foregoing localities, including Utah, in connection with *L. torrens*.

***Leptoconops bezzii*, Noé.**

Mycterotypus bezzii, Noé, Atti R. Accad. Lincei, Ser. 5, Rendiconti xiv, p. 114 (1905) ; Arch. Zool. Napoli, iii, p. 137 (1907).

Leptoconops hyalinipennis, Kieff., Ann. Mus. Nat. Hung. xvi, p. 33 (1918).

The following description of *L. bezzii* (♀) is drawn up from specimens collected in Central Italy and sent me by Professor M. Bezzi ; to this gentleman I am also indebted for the loan of microscopical preparations of the palpi and antennae of the type male.

♀.—Length of body (two specimens), 2·1 mm. ; length of wing, 1·2 mm. ; length of antenna, 0·56 ; width of head, 0·45 mm.

Head black, clothed on the vertex and occiput with short dark hairs ; clypeus black or blackish brown, with two pairs of short dark hairs ; eyes moderately widely separated, the space between them about one-quarter the width of the head ; frons with a pair of short hairs near the lower margins of the eyes. Proboscis dark brown, Palpi dark brown, with dark hairs ; third segment strongly incrassate, the orifice of the sensory pit very large, narrowly oval, extending almost the entire length of the inner side ; fourth segment subcylindrical, slightly shorter than the third. *Antennae* dark brown, with short dark hairs and clear spines, which are somewhat strongly curved on the distal segments ; fourth to thirteenth segments transversely oval to subspherical, the length from 0·8 to 1·0 the breadth ; fourteenth segment about two and one-quarter times as long as broad, equal in length to the preceding two and one-third segments together. *Thorax* black, sparsely clothed with short black hairs ; scutellum black, with three pairs of dark bristles (one of the small lateral bristles sometimes wanting) ; postscutellum, pleurae and pectus black. *Wings* white, iridescent, the anterior veins arranged as in fig. 8, f; fifth vein bifurcating slightly beyond the end of the costa. Halteres white. *Legs* dark brown or brownish black, the metatarsus and second tarsal segment paler, yellowish brown, each with a pair of apical spines. Claws (fig. 4, d) equal, each with a stout basal tooth. *Abdomen* dark brown, clothed with short black hairs. Lamellae yellowish brown, 0·2 the length of the wing. Spermathecae two, heavily chitinised, oval (70 μ by 54 μ) ; the commencement of the duct only chitinised.

The male obtained and associated with this species by Noé differed from the female chiefly in regard to the palpi, antennae, claws and wings. The antenna consists of fifteen segments, the third (*i.e.* the first segment of the flagellum) being produced basally into a relatively long stalk, and causing the flagellum to be more distinctly separated from the basal segments than in the female ; the fourth to thirteenth segments become progressively longer and narrower, the most proximal segment being very short and broad (0·4 to 0·7 the length), with chitinous thickenings on the distal margins, the thirteenth subspherical basally but produced anteriorly

(the greatest width being 1.8 the length); the fourteenth and fifteenth segments greatly elongate, the former about half the length of the latter, and when united almost equal in length to the remaining segments of the flagellum taken together. The palpi are longer and more slender than in the female, the third segment elongate, scarcely swollen, with the proximal two-thirds of the inner side excavated, the fourth segment somewhat swollen distally, approximately four-fifths the length of the third. The wings are more delicate, and (from Noé's figure, not his interpretation) the first and third veins appear to be fused basally, and to enclose a large interspace distally; the separate distal portion of the first vein is very short and directed abruptly upwards towards the costa, the separate portion of the third vein long, extending at first almost parallel with the costa, then curving gradually upwards to meet it a short distance beyond the middle of the anterior border and above the bifurcation of the fifth vein. The claws, according to Noé, are dissimilar, those on the anterior legs being provided with a long basal tooth, those on the hind legs simple, with a short basal bristle.

Kieffer's description of *L. hyalinipennis* agrees so closely with Noé's description of *L. bezzii*, and with the specimens at my disposal, that I have no hesitation in placing it as a synonym of the latter species.

Habitat. *L. bezzii* is now known to occur in the Roman Campagna, Central Italy, and (as *L. hyalinipennis*) in Tunis (Djebel Djeloud; Korbons; Aouina, Lac Bahira; Tunis, Parc Belvedere).

Leptoconops flaviventris, Kieff.

Leptoconops flaviventris, Kieff., Ann. Mus. Nat. Hung. xvi, pp. 34 and 85 (1918).

Kieffer's description of the female of this species is as follows:—

"♀.—Semblable à *L. hyalinipennis*, sauf les caractères suivants: Bouche plus longue que la hauteur de la tête, dirigée en arrière. Palpes de 3 articles, dont le 1er est mince et un peu plus long que gros, seulement un article après la flexion, comme chez *hyalinipennis*. Antennes à articles 3-12* très transversaux, soies sensorielles plus courtes que les poils des verticilles, 13e en ovoïde allongé, sans verticille, au moins aussi long que les précédents réunis. Mesonotum luisant. Ailes blanches, nervures très pâles. Tarses blanchâtres, articulations sombres. Abdomen jaune soufre. L. 1.3 mm.

Djebel Tunisie. Djeloud (5♀)."

On a later page Kieffer recorded additional specimens, including a male from Asia Minor—"Kyaldja-Su, viii (Naday), 1 ♂; Emirley; Sulejman, H. Yayla; Karapunat, 7 ♀ (Naday)." The male, which he doubtfully associated with this species, is shining black, with brown legs and a pale brown abdomen, but from the description given it is difficult to select any very definite characters by means of which it may be distinguished from the male of *L. bezzii*. Kieffer, however, states that the proboscis is very long and slender—much longer than the height of the head—and that the metatarsi are devoid of spines. Segments four to thirteen of the antenna appear to be similar in form to those of the Italian species, but the distal portions of these organs were evidently damaged, and Kieffer was unable to determine whether fourteen or fifteen segments were present. The claws are merely described as long (more than half the length of the fifth tarsal segment), but apparently the association with *L. flaviventris* would imply that on some of the legs, at least, they are also toothed.

* In this and subsequent direct quotations the number of the antennal segment given by the author cited must, for correctness and uniformity, be increased by one; but in all the descriptive extracts given this change has already been made.

Of the species of *Leptoconops* occurring in the Mediterranean littoral *L. flaviventris* apparently most closely resembles *L. irritans* in general facies. In both species the abdomen is normally pale in colour—whitish or yellowish—but they should be easily separated by the structure of the claws.

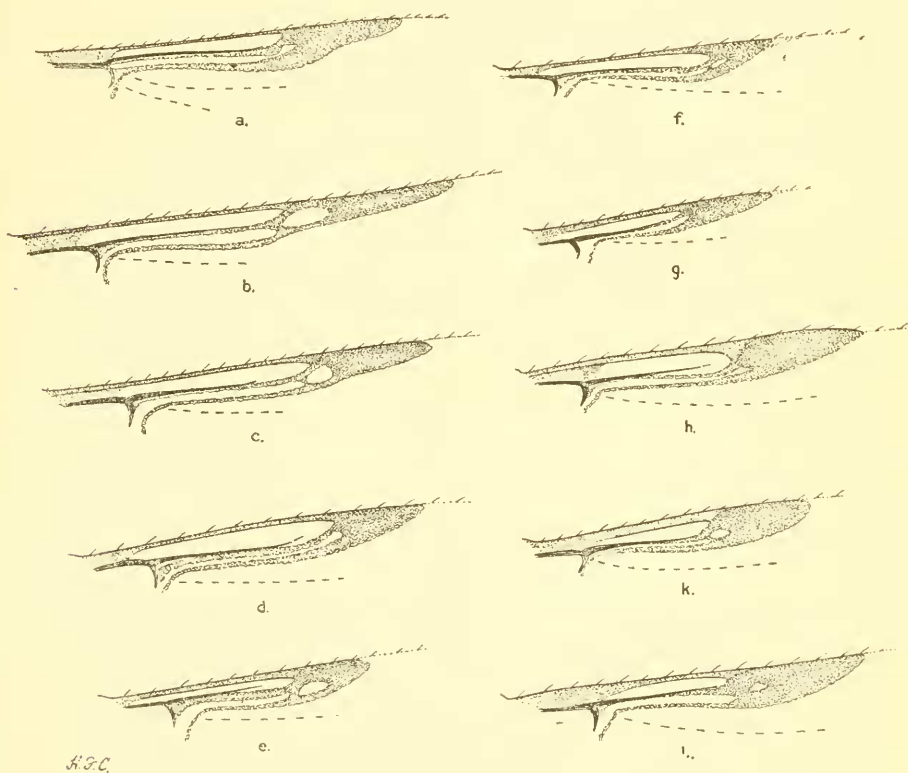


Fig. 8. Basal portions of wings of females of : (a) *L. stygius*, Sk. ; (b) *L. longicornis*, sp. n. ; (c) *L. grandis*, sp. n. ; (d) *L. siamensis*, sp. n. ; (e) *L. torrens*, Twms. ; (f) *L. bezzi*, Noé ; (g) *L. braziliensis*, Lutz ; (h) *L. kerteszi*, Kieff. ; (i) *L. kerteszi* var. *americanus*, n. ; (l) *A. spinosifrons*, sp. n. (b, c, d, $\times 50$ circa ; the rest $\times 75$).

***Leptoconops indicus*, Kieff.**

Schizoconops indicus, Kieff., Ann. Mus. Nat. Hung. xvi, p. 135 (1918).

This species was made the type of the genus *Schizoconops* by Kieffer on account of its toothed or bifid unguis. This character alone, however, cannot be considered of sufficient importance to warrant the creation of a new genus ; and even were it of subgeneric value the name *Schizoconops* would sink under *Mycterotypus* (see p. 3).

The chief characters, taken from Kieffer's description, are as follows :—

♀.—Shining black. *Antennae* brown, the fourth to the thirteenth segments transverse, at least twice as broad as long ; fourteenth segment conical, equal in length to the four preceding segments together. *Wings* white, with pale veins ; first and third veins not reaching the middle of the anterior border, fifth vein bifurcating much beyond the extremity of the third vein. *Halteres* white. *Legs* pale

brown, tarsi whitish, metatarsi without spines; anterior femora slightly thickened; claws bifid, equal, the branch shorter. *Abdomen* red; lamellae long and whitish.

Length 1.5 mm.

Habitat. Bengal: Champaran, Bettiah, iii, 1908.

This species should be easily recognised by the structure of the claws, the absence of spines on the metatarsi, and the relative positions of the extremity of the third vein and bifurcation of the fifth vein; that the latter should take place considerably beyond ("très distale") the junction of the third vein with the costa is unusual.

***Leptoconops siamensis*, sp. nov.**

♀.—Length of body, 3.5 mm.; length of wing, 1.8 mm.; length of antenna, 0.6 mm.; width of head, 0.43 mm.

Head dull brown, the antennal depression creamy-white, clothed with dark brown hairs on the occiput; clypeus rather paler brown, with four dark brown hairs on each side of the middle line; eyes relatively not very widely separated, the space between them almost one-fifth the greatest width of the head and devoid of hairs. Proboscis pale brown. Palpi (fig. 2, *f*) pale brown, with brown hairs; third and fourth segments elongate, subequal; the third strongly incrassate, with a deep sensory pore, the orifice of which is very large and occupies almost the entire length of the inner side. *Antennae* moderately long, yellowish brown, with short pale brown hairs and slightly curved, pointed, transparent spines; segments 4 to 13 subspherical to oval, the length varying from 0.8 to 1.3 times the breadth; terminal segment (fig. 5, *a*) elongate, equal in length to the preceding two and one-third segments together. *Thorax*: disc dark umber-brown, pollinose, clothed with short brown hairs; prothoracic lobes and humeral callus yellowish brown; scutellum and postscutellum rather darker than the disc, the former with three pairs of strong median bristles and two pairs of small lateral hairs; pleurae and pectus dark umber-brown. *Wings* whitish, venation normal, the first and third veins (fig. 8, *d*) fused distally, not forming an interspace. *Legs* entirely brownish yellow, bearing pale brown hairs and, on some of the tarsal segments, stout blackish spines; fore femora and tibiae slightly swollen and somewhat shortened, tibia of all the legs with an apical spur; metatarsi each with two sub-ventral or ventro-lateral rows of strong spines,* the second and third tarsal segments of the fore and middle legs each with two apical spines, of hind legs wanting. Claws (fig. 4, *f*) of fore and middle legs equal, each with a large (at least half the length of the claw) strong tooth arising from the base. *Abdomen* waxen creamy white above and below, clothed with short hairs. Lamellae brownish yellow, approximately 0.25 times the length of the wing. Spermathecae two, rather narrowly oval ($65\mu \times 38\mu$), highly chitinated; commencement of the duct chitinated for a very short distance.

Habitat. Siam: Patani Cape (*H. C. Robinson & N. Annandale*). One female (type) in the British Museum Collection.

This species is not closely allied to any of the known members of *Leptoconops* (*sens. lat.*); it agrees with *L. indicus* in regard to the structure of the claws, but may readily be separated therefrom by its relatively large size and the powerful spinose armature of its metatarsi. In the latter character and the reduction in length of the fore legs it suggests *Acanthoconops* (*q.v.*).

* The development of these spines has not proceeded uniformly, and although normally paired, the spine on one side is often much smaller than that on the other and may be represented by a strong bristle. The number of spines present on the same segments of corresponding legs therefore varies, and on the metatarsi of the single specimen available was—fore legs 18 and 15, middle legs 14 and 15, hind legs 9 and ? (the metatarsus of the corresponding leg missing).

Subgenus **Holoconops**, Kieff.

Holoconops, Kieff., Ann. Mus. Nat. Hung. xvi, p. 135 (1918).

This subgenus comprises those species of *Leptoconops* (*sens. lat.*) in which the antennae of the female are composed of thirteen segments; in all the known species the claws in this sex are simple and equal. The group was given generic rank by Kieffer, who based its separation upon the structure of the female antennae and claws. Such a combination of characters, however, cannot be maintained, since the structure of the claws is in no way peculiar, and this author's restriction of the type mentioned above to *Holoconops* is evidently due to a misconception. Kieffer designated *L. kerteszi*, Kieff., as his genotype, and, in a footnote, associated it with *L. flaviventris*, Kieff., *L. hyalinipennis*, Kieff. (synonymous with *L. bezzii*, Noé), and *L. lacteipennis*, Kieff.; but the inclusion in this group of the second and third-named species is a palpable oversight, as in his descriptions of them on preceding pages of the same article the antennae are definitely stated to possess the full complement of segments (fourteen).

Three species of this subgenus are here recognised, but one (*L. interruptus*, End.) is insufficiently described, and may subsequently prove identical with one of the others. They are widely distributed, and have been recorded from Northern Africa, Asia Minor, South West Africa and the United States of America.

Leptoconops kerteszi, Kieff.

Leptoconops kerteszi, Kieff., Ann. Mus. Nat. Hung. vi, p. 576 (1908).

Mycterotypus lauræ, Weiss, Arch. Inst. Pasteur de Tunis, pp. 25-32 (1912).

Mycterotypus lauræ var. *peneti*, Langeron, Arch. de Parasit. xvi, pp. 282-301 (1913).

The synonymy given above is based upon examinations of specimens sent me as *L. kerteszi* by Mr. F. C. Willcocks from Egypt, and of females of *L. lauræ* sent me by M. A. Weiss from Tunis. *L. kerteszi* was described by Kieffer from specimens collected at Cairo, and the material received from Mr. Willcocks agrees in detail with this author's descriptions. Furthermore Kieffer, who is evidently unacquainted with *L. lauræ*, has recently (1918) recorded *L. kerteszi* from Tunis.

The following description is compiled from the Egyptian and Tunisian specimens referred to above.

♀.—Length of body (six specimens), 1·8–2·1 mm.; length of wing, 1·1–1·3 mm.; length of antenna, 0·33–0·42 mm.; width of head, 0·31–0·34 mm.

Head shining black, the antennal depressions pale buff, sparsely clothed on the vertex and occiput with short black hairs; clypeus shining black, with three pairs of dark hairs; eyes relatively widely separated, the space between them being approximately two-fifths the width of the head. Proboscis dark brown or black. Palpi (*cf.* fig. 2, *d*) dark brown, with brown hairs; third segment very strongly swollen, with a large oval pore situated near the middle, fourth segment slightly inflated distally, scarcely shorter than the third. *Antennae* (*cf.* fig. 5, *g*) dark brown, with rather long (about twice the length of the segment) pale brown hairs; fourth to twelfth segments transversely oval to spherical, from 0·8 to 1·0 as long as broad; thirteenth segment equal in length to the preceding three and one-third to four segments together. *Thorax* entirely shining black, with short black hairs; scutellum with two pairs of bristles. *Wings* white, iridescent; venation normal, the anterior veins not quite reaching the middle of the anterior border and arranged as in fig. 8, *h*; fifth vein bifurcating slightly before the extremities of the costa and third veins. Halteres whitish. *Legs* dark brown, clothed with dark hairs; metatarsi of the hind legs paler brown, with short brownish yellow hairs; fore and middle metatarsi with a basal and apical pair of slender, pointed spines, and a few (one to four) central, usually unpaired,

spines; hind metatarsi and second segments of all the legs with a pair of similar spines at the extremities. Claws (*cf.* fig. 4, *c*) simple and equal, each with a short bristle arising from the base. *Abdomen* dark brown, the margins of some of the tergites narrowly grey, sparsely clothed with short brown hairs. Lamellae pale brown, 0.25 the length of the wing. Spermathecae two (a third very small, narrowly oval one is often present), heavily chitinated, obovate, ($47\mu \times 36\mu$); a minute portion only of the duct chitinated.

The male was described by Weiss, who stated that it was uniformly darker in colour than the female, and gave the following measurements:—Length of body, 1.5 mm.; length of antennae (barely), 0.5 mm. Judging by this author's description and figures, it presents certain striking morphological differences from those males which have been associated with species of *Leptoconops* (*sens. str.*). The eyes are said to meet at a point above; the palpal segments are depicted as subequal in length and about three times as long as wide; the fourth antennal segment almost twice as long as the fifth, the fifth to twelfth short and broad, subequal, the last three segments elongate, but the thirteenth almost equal in length to the fourteenth and fifteenth taken together; and the wings with reduced venation—the fourth vein being absent.

Habitat. Egypt: Cairo, Behera, Wadi Natroun, Sakkara (*Willcocks*). Tunis: Tabeditt (*Weiss*).

Willcocks (1917) states that the species was first sent from Behera in March 1907, and that it is common at certain seasons in Wadi Natroun, and in the autumn, when the Nile is in flood, from Mena House to Sakkara.

***Leptoconops kerteszi* var. *peneti*, Langeron.**

♀.—Length of body, 1.5–1.8 mm.; length of wing, 1.06 mm.; length of antenna (from figure), 0.45 mm.

According to Langeron this variety differs from the specimens (type series) of *M. laurae* in the Paris Museum principally in being larger, darker, and possessing more numerous and stronger bristles and spines. In particular, he compares the development and exact arrangement of the metatarsal spines in the two forms. He also maintains that biological differences exist: the variety appears to persist later in the year, occurs in a more southerly region, and at a much lower altitude than is recorded by Weiss for the type form. *M. laurae* came from a mountainous region (altitude 500 metres), while the var. *peneti* was found in the desert (mean altitude 30 metres), in the marshes lying between the oases of El Hamma and the Shott Gharsa.

In view of the individual variation in regard to size, and number and arrangement of the metatarsal spines observed in a series of specimens of *L. kerteszi*, the distinguishing points cited by Langeron can scarcely be granted even varietal value; but in this author's excellent and detailed description of his specimens, mention is made of a character which is of much greater importance, and which raises doubt regarding its specific identity. The ungual formula is stated to be 0.1–0.1–0.1, and the external claw of each leg is said to bear a small basal tooth. Such a condition occurs in no other species of *Leptoconops*, and therefore, if Langeron's interpretation be correct, the form should be easily recognised and would deserve specific rank. It should be noted, however, that in some species the base of the claw is relatively broad and projects slightly ventrally, so that, in certain positions, a minute basal tooth appears to be present.

***Leptoconops kerteszi* var. *americanus*, nov.**

♀.—Length of body (three specimens), 1.75 mm.; length of wing, 1.1 mm.; length of antenna, 0.32 mm.; width of head, 0.30 mm.

In spite of their widely distant places of origin I have been unable to find any satisfactory characters for separating specimens from Utah (received through the

kindness of Professor L. O. Howard and Dr. J. M. Aldrich) from typical examples of *L. kerteszi*. Indeed, allowing for minute differences which come within the range of individual variation, the only distinguishing details appear to be the formation of an interspace by the first and third veins (fig. 8, *k*) and the slightly different form of the spermathecae. These are almost spherical in the Utah specimens, whereas they are obovate in the Mediterranean examples. Males of both forms, when forthcoming and compared, may possibly reveal distinctive antennal or genital characters, but until such time the American form can, at the most, be accorded varietal rank.

Habitat. United States of America: Utah, Salt Lake, June, "biting devilishly" (*H. S. Barber*). Three females (cotypes) in the collections of the United States National Museum and Liverpool School of Tropical Medicine.

***Leptoconops lacteipennis*, Kieff.**

Leptoconops lacteipennis, Kieff., Ann. Mus. Nat. Hung. xvi, p. 32 (1918).

This species, described from a female captured in Tunis, apparently differs from *L. kerteszi* chiefly in the metatarsi being devoid of spines, the segments of the flagellum more uniformly transversely oval, and the fifth tarsal segment shorter than the fourth. The last character should enable the species to be identified without difficulty, since, so far as I am aware, it is unique in this respect.

The more important of the specific characters given by Kieffer are as follows:—

♀.—Black. Fourth to twelfth antennal segments transverse (from the figure accompanying the description, the length varies from 0.6 to 0.7 times the breadth), thirteenth segment slightly longer than the three preceding segments together. Mesonotum shining. Halteres white. Wings milky white, extending almost to the tip of the abdomen; third vein reaching almost to the middle of the wing, fifth vein bifurcating slightly before the extremity of the third vein. Legs black, without spines, tarsi brown; tarsal segments 1 to 4 gradually decreasing in length, the fifth segment shorter than the fourth. Claws simple, equal, each with a bristle arising from the base. Abdomen brownish black. Length, 2 mm.

***Leptoconops interruptus*, End.**

Mycterotypus interruptus, End., Denks. Med. Ges. Jena, i, pp. 133-162 (1908).

The description of this species given by Enderlein relates largely to characters of a general nature, and details which, in the light of our present knowledge of the group, must be considered of value in separating such closely allied forms receive little attention. Nevertheless, with the help of the figures accompanying the description, it would appear that *L. interruptus* is very close to, if not identical with, *L. kerteszi*. Weiss (1912) observed the close relationship existing between these species, and especially noted the affinities existing in regard to the spinose armature of the metatarsi and the structure of the antennae. Since, however, the exact arrangement of the metatarsal spines is not of specific importance, it seems that the only tangible differential character is afforded by the antennae. Enderlein states that the third to twelfth segments are spherical, and that the last segment is twice as long as broad; this would indicate, also, that the terminal segment was approximately equal in length to the two preceding segments together. In *L. kerteszi* the last segment is at least three times as long as broad, and is equal in length to the three to four preceding segments.

A re-examination of the type or the examination of further material from South-West Africa (Enderlein's example came from Rooibank, hinterland of Walfish Bay) is necessary, before a decision regarding the validity of one or both of these species can be made.

Genus **Acanthoconops**, nov.*

Frons clothed with bristles or spines. Antennae in the female pilose, composed of fourteen segments, the fourth to thirteenth short and broad, subspherical, the fourteenth elongate, subconical. Eyes, palpi, proboscis and wings as in *Leptoconops*, Sk. (*sens. lat.*). Fore legs relatively short, the fore and hind femora and tibiae strongly incrassate, the middle femora moderately incrassate; claws equal, each with a tooth arising from the base; empodium bristle-like. Ovipositor somewhat triangular, very short, considerably broader than long.

Genotype: *A. spinosifrons*, sp. nov.

This genus is very closely allied to *Leptoconops* (*sens. lat.*), but may readily be distinguished by the remarkably short ovipositor (fig. 9), and by the vestiture of the head. In *Leptoconops* (*sens. lat.*) the whole of the frons (*i.e.*, the wide area extending from the vertex to the clypeus) is bare, or, at most, possesses a single pair of bristles between the eyes, while in *Acanthoconops* it bears numerous spines or bristles (*cf.* fig. 1, *a* and *b*). Further, in the two species of *Acanthoconops* at present known the fore legs are noticeably shortened, and the metatarsi of all the legs armed with formidable spines. The ratio of the combined lengths of the femora and tibiae of the fore legs to those of the hind legs is 1 : 1·5, or but slightly less; in *Leptoconops* this ratio is rarely more than 1 : 1·2, and not infrequently is 1 : 1. In this connection it may be of interest to note that, among the members of the latter genus, the ratio given for *Acanthoconops* is (so far as can be determined from the material available) most nearly approached in the case of *L. siamensis*, sp. n. In this species, which also possesses powerful spines on the metatarsi, the ratio is almost 1 : 1·4.

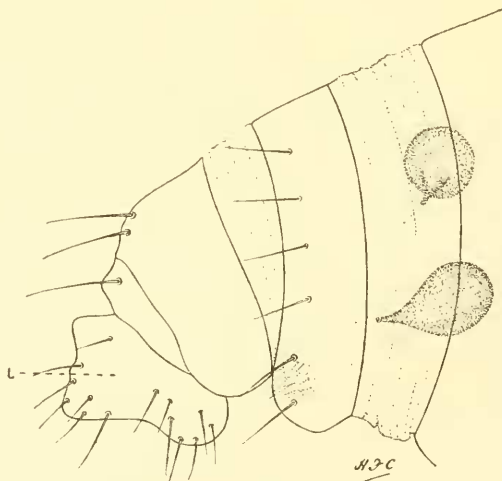


Fig. 9. Extremity of abdomen of *Acanthoconops spinosifrons*, sp. n., ♀, showing lamellae (*l*); side view ($\times 220$ circa).

Acanthoconops spinosifrons, sp. nov.

♀.—Length of body (two specimens mounted in Canada balsam), 2·3 mm.; length of wing, 1·2 mm.; length of antenna, 0·35 mm.; width of head, 0·32 mm.

Head dull black, with short, stout, pointed, backwardly directed, tuberculate spines scattered over the occiput and frons, on the lower portion of which they are more numerous; clypeus shining dark brown, with a group of spines centrally and a

* ακανθα spine, and κορυφή gnat.

few (three pairs) relatively short black hairs; eyes widely separated above and below, the space between them at the vertex being rather more than one-third the greatest width of the head. Proboscis dark brown. Palpi (fig. 2, *e*) dark brown, the apical segment yellowish brown, clothed with short dark hairs; apparently composed of three segments, the two small basal segments being almost fused together; orifice of the sensory pit in the third segment small, subcircular, situated in the proximal third. *Antennae* (fig. 5, *f*) relatively short, dark brown, with short glistening hairs and short, straight or slightly curved spines; segments 4 to 13 transversely oval to subspherical, the length varying from 0.6 to 0.8 of the breadth, the fourteenth

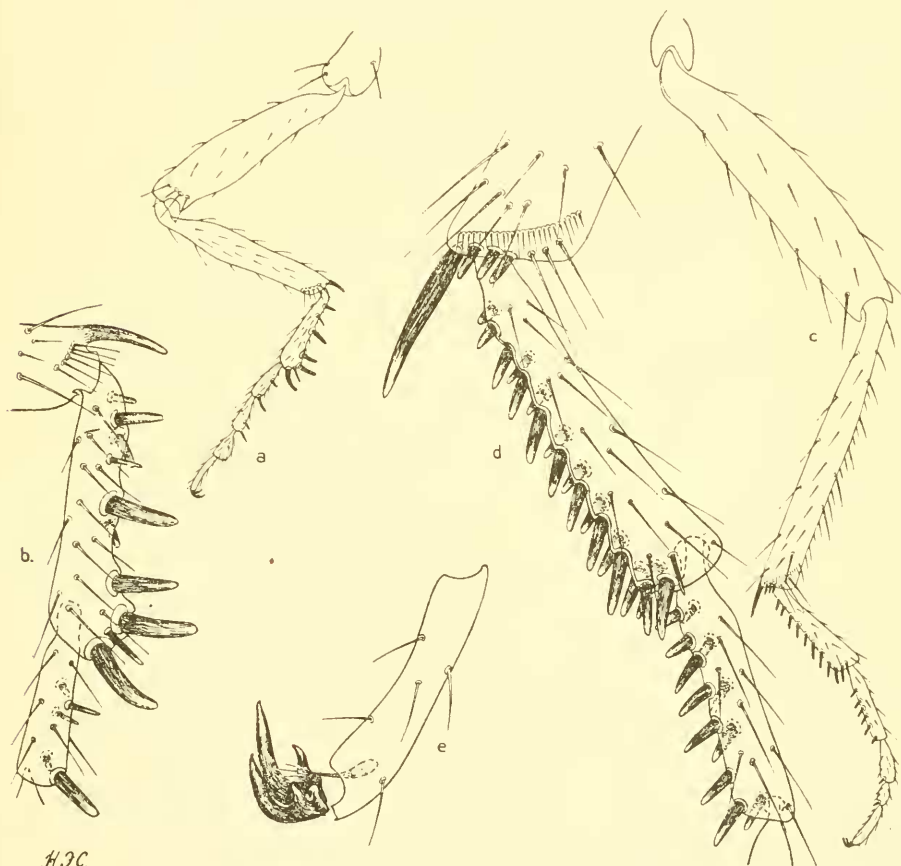


Fig. 10. *Acanthoconops spinosifrons*, sp. n., ♀: *a*, front leg ($\times 85$); *b*, first and second tarsal segments of front leg ($\times 295$); *c*, hind leg ($\times 85$); *d*, first and second tarsal segments of hind leg ($\times 295$); *e*, fifth tarsal segment of hind leg ($\times 550$).

segment equal in length to the preceding two and one-half segments together. *Thorax* and scutellum shining black, the dorsum clothed with short brown hairs; scutellum bearing two pairs of large, and one or two pairs of small bristles; pleurae and pectus shining black. *Wings* glassy, strongly iridescent; the anterior veins as shown in fig. 8, *l*, the fifth vein bifurcating almost immediately below the extremity of the third vein. Halteres with white knobs and infuscated stems. *Legs* (fig. 10) pale brown, the distal two-thirds or three-fourths of the femora, and the distal third of the fore and hind tibiae, black, clothed with brown hairs; tibiae each with a strong apical spur, fore tibiae incrassate, hind tibiae with five strong, blunt, black spines on

the outer side at the apex, and with three of the bristles of the posterior transverse distal row (situated on the inner aspect) replaced by similar but smaller spines; metatarsi, particularly those of the hind legs, short, fore and hind metatarsi incrassate; fore and hind tarsi with stout, blunt black spines arranged as shown in fig. 10, middle tarsi with six or seven pairs of similar spines on the first segment and the apical bristles of the second and third segments differentiated—spine-like. Claws (fig. 10, *e*) equal, the basal tooth stout. *Abdomen* translucent creamy white, but appearing in engorged or partly fed specimens dark brown or cream-coloured, with dark central bands on the proximal segments; clothed with pale hairs. Lamellae creamy white, clothed with pale hairs. Spermathecae two in number, heavily chitinised, oval ($53\mu \times 37\mu$); the commencement of the duct chitinised for a relatively long distance (18μ).

Habitat. Zanzibar (*Dr. W. M. Aders*), seven females (including three cotypes). The labels attached to the specimens bear the following data: on buffalo; Pigaduri, Zanzibar, 13.iv.19. In the collection of the Imperial Bureau of Entomology.

***Acanthoconops albiventris*, de Meijere.**

Leptoconops albiventris, de Meijere, Tijds. voor Ent. lviii, p. 98 (1915).

Leptoconops spinosipes, Kieff., Ann. Mus. Nat. Hung. xv, p. 190 (1917).

♀.—Length of body (two specimens), 1.8 mm.; length of wing, 1.0 mm.; length of antenna, 0.3 mm.; width of head, 0.32 mm.

Through the courtesy of Professor de Meijere, I have been able to examine females of this species, which was described by him from specimens collected in New Guinea. This author noticed and commented upon the unusual form of the lamellae, but retained the species in *Leptoconops*, and apparently did not observe closely the arrangement of the hairs on the head; this he stated was "kaum behaart." *A. albiventris* is closely allied to the preceding species, but is smaller, and possesses somewhat less powerful, though similarly arranged, spines on the legs. Morphologically, it may readily be separated from *A. spinosifrons* by (1) the frons bearing numerous short hairs or bristles instead of spines; (2) the terminal segment of the antennae being relatively longer (equal in length to the preceding three and one-third segments instead of the preceding two and one-half); (3) the bristles forming the posterior transverse distal row on the hind tibiae all being normal, none replaced by spines; (4) the hind metatarsus being relatively longer (about one-half the length of the tibiae, whereas in *A. spinosifrons* it is about one-third the length); and (5) the tooth of the claws being distinctly smaller.

The synonymy given above seems extremely probable from a comparison of the descriptions, and in view of the fact that Kieffer's specimens also came from New Guinea (Tamara, Berlinhafen). Discrepancies in the descriptions are slight, and Kieffer's statement that the abdomen is red, sometimes white, with brownish markings, is of little consequence, as it suggests that some (possibly most) of his examples were wholly or partly engorged with blood.

This species appears to be a vicious biter and, at times, a serious pest in parts of New Guinea; K. Gjellemp, the collector of de Meijere's material, attached the following information to the specimens—"An der Mundung des Sermowai-Flusses in sehr grosser Anzahl vorhanden und durch ihr Stechen eine grosse Plage bildend, 16 Mai 1911."

The distinguishing characters of the known species (females) of *Leptoconops* (*sens. lat.*) and *Acanthoconops* are summarised in the following table.

(1) Lamellae elongate; frons bare or with a single pair of hairs between the eyes (<i>Leptoconops</i> , <i>sens. lat.</i>)	2
Lamellae very short; frons with numerous spines or hairs (<i>Acanthoconops</i>)		17

- (2) Antennae composed of fourteen segments (*Leptoconops*, sens. str.) 3
 Antennae composed of thirteen segments (*Holoconops*, subgen.) 13
- (3) Claws simple 4
 Claws toothed 10
- (4) Metatarsi with distinct spines 5
 Metatarsi without spines (excluding the pair at the apex) 6
- (5) Abdomen whitish or yellow; lamellae approximately one-fifth the length of the wing *irritans*, Noé (p. 14).
 Abdomen dark brown; lamellae approximately one-third the length of the wing *braziliensis*, Lutz (p. 13).
- (6) Fifth vein bifurcating considerably beyond extremity of costa
rhodesiensis, sp. n. (p. 14).
 Fifth vein bifurcating before or below extremity of costa 7
- (7) Third palpal segment greatly swollen; antennal segments 4-13 distinctly broader than long (American species) *torrens*, Twms. (p. 15).
 Third palpal segment elongate, slightly swollen; antennal segments 4-13 subspherical or longer than broad (Australian species) 8
- (8) Smaller species (wing length 1.3 mm.); last antennal segment less than twice as broad as long *stygius*, Skuse (p. 10).
 Larger species (wing length 2.0 mm.); last antennal segment more than three times as broad as long 9
- (9) Antennae very long, last segment at least six times as long as broad
longicornis, sp. n. (p. 11).
 Antennae shorter, last segment at most three and one-half times as broad as long *grandis*, sp. n. (p. 12).
- (10) Metatarsi with very large spines *siamensis*, sp. n. (p. 20).
 Metatarsi without spines (excluding the pair at the apex) 11
- (11) Antennal segments 4-13 transversely oval to spherical, the last segment slightly longer than the two preceding together *bezzii*, Noé (p. 17).
 Antennal segments 4-13 all broader than long, the last segment as long as the three or four preceding together 12
- (12) Abdomen yellow; last antennal segment as long as the three preceding together *flaviventris*, Kieff. (p. 18).
 Abdomen red; last antennal segment as long as the four preceding *indicus*, Kieff. (p. 19).
- (13) Metatarsi without spines; fifth tarsal segment shorter than fourth
lacteipennis, Kieff. (p. 23).
 Metatarsi with distinct spines; fifth tarsal segment longer than fourth .. 14
- (14) Last antennal segment twice as long as broad, segments 4-12 spherical
interruptus, End. (p. 23).
 Last antennal segment three to four times as long as broad, segments 4-12 transversely oval to spherical 15
- (15) Claws equal, one simple, the other with a minute basal tooth
kerteszi var. *puncti*, Langeron (p. 22).
 Claws equal and simple 16
- (16) Spermathecae obovate, narrow anteriorly (Mediterranean Region)
kerteszi, Kieff. (p. 21).
 Spermathecae subspherical (America) *kerteszi* var. *americanus*, n. (p. 22).

- | | |
|--|---------------------------------------|
| (17) Frons spiny (Tropical Africa) | <i>spinosifrons</i> , sp. n. (p. 24). |
| Frons hairy (New Guinea) | <i>albiventris</i> , Meij. (p. 26). |

References.

- CASTELLANI, A. & CHALMERS, A. J. (1913). A Manual of Tropical Medicine. London, 2nd ed., p. 678.
- „ „ (1919). *Ibid.* 3rd ed., p. 803.
- CHATTON, E. & BLANC, G. (1917). Notes et réflexions sur les Toxoplasmes et la Toxoplasmose du Gondi (*Toxoplasma gondii*, Nicolle et Marceaux, 1909).—Arch. Inst. Past. Tunis, x., pp. 1-40.
- GRASSI, B. (1901). Die Malaria: Studien eines Zoologen. Jena, pp. 118-122.
- JOHANNSEN, O. A. (1905). Aquatic Nematoceros Diptera, II.—N.Y. Sta. Mus. Bull. No. 86, pp. 94-96.
- KIEFFER, J. J. (1906). Chironomidae. Genera Insectorum. Wytsman. 42^e fasc. Diptera, pp. 44-48.
- „ (1908). Description d'une espèce nouvelle de Chironomides d'Egypte.—Ann. Mus. Nat. Hung. vi.
- „ (1917). Chironomidae d'Australie.—*Ibid.* xv, pp. 189-191.
- „ (1918). Chironomides d'Afrique et d'Asie.—*Ibid.* xvi, pp. 31-136.
- LANGERON, M. (1913). *Mycterotypus lauræ*; description d'une variété nouvelle (*M. lauræ* var. *peneti*).—Arch. Parasit. xvi, pp. 282-304.
- LUTZ, A. (1912). Contribuição para o estudo das Ceratopogoninas haematofagas do Brazil.—Mem. Inst. Osw. Cruz, iv, p. 24.
- „ (1913). Do.—*Ibid.* v, pp. 45-72.
- MALLOCH, J. R. (1915). The Chironomidae, or Midges, of Illinois, with particular reference to the species occurring in the Illinois River.—Bull. Ill. Sta. Lab. Nat. Hist. x, Art. 6, p. 401.
- MEIJERE, J. C. H. de (1915.) Diptera aus Nord-Neu Guinea.—Tijds. voor Ent. lviii, pp. 98-101.
- MIK (1894). Wiener Ent. Zeit. xiii, p. 164.
- NOÉ, G. (1905). Un nuovo genere appartenente alla famiglia Chironomidae.—Atti. della Reale Accad. dei Lincei, Ser. 5, Rendiconti, xiv, pp. 114-120.
- „ (1907). Due nuove specie di Ditteri appartenenti ad un genere nuovo.—Arch. Zool. Napoli, iii, pp. 101-164.
- PRATT, F. C. (1907). Notes on "Punkies."—U.S. Dept. Agric. Bur. Ent. Bull. No. 64, part 3, pp. 23-28.
- SAMBON, L. W. (1913). The Causation of Pellagra: a Contribution to the Discussion on Dr. Sandwith's Paper.—Trans. Soc. Trop. Med. & Hyg. vi, pp. 231-241.
- SKUSE, A. A. (1890). Diptera of Australia. Part VI. The Chironomidae.—Proc. Linn. Soc. N.S.W. (2nd Ser.), iv, p. 288.
- TOWNSEND, C. H. T. (1893). An interesting Blood-sucking Gnat of the family Chironomidae.—Psyche, vi, p. 369-371.
- WEISS, A. (1912). *Mycterotypus lauræ*, n. sp., Chironomide nouveau du Sud Tunisien.—Arch. Inst. Past. Tunis, pp. 25-32.
- WILLCOCKS, F. C. (1918). Notes on some Insects found in Egypt of Medical and Veterinary Interest.—Bull. Soc. Ent. d'Egypte, 3rd fasc., July-Sept., p. 84.